DO NOT REMOVE FROM REPAIR CAR
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Subject: TYPE 3564 HIGHWAY CROSSING GATE MECHANISMS	SERVICE SPECIFICATION	
	Number	4504
	Date	January 10, 1948 Rev.: 6-27-51
	15 Sheets	

For general information regarding the motor, gears, lubrication, torque adjustment, slot, and circuit controller, refer to the instruction pamphlet under the spring clip inside the mechanism cover.

This specification provides supplemental information for shop overhaul and adjustment of Type 3564 crossing gate mechanisms of both the gravity and drive-down types.

Reference numbers used herein refer to sections and diagrams in the instruction pamphlet.

I. MOTOR

A. Air Gap: 0.020 in. min. between pole pieces and armature pole pieces - should not be disturbed.

B. Commutator: Should commutator become grooved or threaded, remove armature from motor and carefully refinish commutator to a smooth, even, polished surface.

C. Motor Brush Pressure: 3 to 4 ounces. If readjustment is required, remove brush holder from motor head. Straighten edge of adjusting washer which extends above the casting; loosen the elastic stop nut on the stud; turn the adjusting washer until correct pressure of 3 to 3-1/4 ounces is obtained with brush removed and flat spring bearing on the casting; retighten the elastic stop nut and rebend edge of adjusting washer around rear edge of casting to lock in place.

D. Motor Shaft end play: 1/64 in. to 3/64 in. End play may be adjusted by use of thin washers at front end of motor shaft adjacent to the ball bearing in the removable head.

E. With plus battery applied to top (armature) binding post on right side (when facing commutator end of motor) and minus battery applied to bottom (field) binding post, on same side of motor, no-load current at

8 volts should be not more than 1.0 amp. On motors used in mechanisms motor driven in both directions of gate arm travel, it will be necessary when making this test to place a temporary jumper connection across the binding posts on the left side of the motor.

F. On Motor for Gravity-Down Mechanisms And On Motor for Drive-Down Mechanisms with friction clutch only.

1. Friction clutch with pinion should be adjusted per Section III.

G. On Motor for Power-Down Mechanisms with centrifugal governor.

1. With counterweights up against stops and rotated clockwise to the end of cam slots giving least brake clearance--
   (a) Disc faces should be parallel and should hold 0.015 in. spacer but not nold 0.010 in. spacer.
   (b) Hold this adjustment by tightening the lock nut on the adjusting screw.
   (c) Adjust eccentric studs to give minimum centrifuge spring length.
2. Friction clutch should be adjusted per Section III.

II. SLOT

A. Core, Armature and Bracket Assembly

1. Main Armature Pivot Shaft
   (a) Side play: 0.0025 in. to 0.0070 in.
   (b) End play: 1/64 in. min.
2. Armature Bar, Ref.15, Fig. 7 or Fig. 12
   (a) Side play: 0.0025 in. to 0.0070 in.
   (b) End play: 0.014 in. to 0.026 in.
3. All parts should be entirely free in operation.
4. Armature Air gap - With armature in the energized position, air gap should be nominal 0.013 in. parallel and not less than 0.012 in. at any point.

B. Lock Arm Assembly

1. Pivot Shaft
   (a) Side Play: 0.0025 in. to 0.0070 in.
   (b) End play: 0.015 in. to 0.025 in.

2. Lock Pawl, Ref.3, Fig. 7 or Fig. 12
   (a) Side play: 0.003 in. to 0.005 in.
   (b) End play: 0.010 in. to 0.020 in.
   (c) Pawl return spring, Ref.5, should pull pawl to stop, Ref.6, freely.
   (d) Pawl should operate freely through full stroke.
   (e) Tip of pawl should be parallel to ratchet gear teeth.
3. Connecting Pin, between locking arm and armature bar.
   (a) End play: 0.010 in. min.
   (b) Should operate freely without tendency to bind or stick.
   (c) Should have 0.015 in. min. clearance from ends of elongated holes in locking arm at both extreme positions of locking arm motion.
4. Adjustment
   (a) Motion of armature at bottom edge: approx. 9/16 in.
   (Adjust by means of stop screw, Ref.22, Fig.7 or Fig.12)
   (b) Clearance between tip of locking pawl and tips of ratchet gear teeth: 0.025 in. min. with slot magnets deenergized.
   (c) Locking arm should be centered relative to the armature bar.
5. Locking arm must not touch armature bracket or other stationary parts.

C. Ratchet Gear and Flexible Coupling, Ref.1, Fig.7 or Fig.12
1. Should fit the motor shaft closely but should be free on the shaft.

D. Armature Bar Adjustment.
1. With stop screw, Ref.14, Fig.7 or Fig.12, against core support casting,
   (a) Tip of locking pawl should just touch bottom of spaces between teeth of ratchet gear.
   (b) Clearance between armature and pole faces should be 0.070 in. to 0.100 in. at lower edge of armature.
2. Armature bar springs.
   (a) Guide pins should have free fit in holes in armature bar, Ref.15, Fig.7 or Fig.12.
   (b) Nuts, Ref.16, Fig.7 or Fig.12, should be backed off approximately 1-1/2 turns from point where springs are compressed solid. Lock in place with cotter pins.

E. Contacts

1. Slots equipped with contacts should have heel contacts and contact support lined up and tightened on armature bar, Ref.15, Fig.7, so that the springs are in alignment with each other and extend straight out from their supports.
2. Front Contact Springs should have:
   (a) With tip of locking pawl touching tip of tooth or ratchet gear,
      (1) One ounce initial pressure.
      (2) 1/32 in. compression.
   (b) With locking pawl raised to fully engaged position,
      (1) Approx. four ounces pressure.
   (c) Carbon tips touching heel contact tips not more than 1/16 in. below center when fully compressed nor more than 1/16 in. above center when contact is just made.
   (d) Contacts made square across their width.
3. Back Contacts should have:
   (a) Minimum opening of 0.020 in. with front contacts just made.
   (b) Contacts made square across their width.
   (c) Alignment so that contacts slide to just above center when fully compressed.
   (d) Stops adjusted for only small amount of initial pressure.
   (e) Compression: 0.030 in. min. with 0.050 in. min. front contact opening.

F. Snubbing Relay

1. Armature
   (a) End play at pivot: 0.010 in. to 0.020 in.
   (b) Air gap (energized position):
      Pivot end: 0.013 in. to 0.018 in.
      Core end: 0.014 in. to 0.016 in.
2. Hold Down Spring
   (a) Tapered ends of studs should be in line vertically with coil energized and armature picked up.
   (b) Locking spring, Ref.17, Fig.12, should:

(1) Prevent adjusting nut, Ref.19, Fig.12, from turning.

(2) Clear heel contact arm by 1/8 in. min. at side.

3. Contacts

(a) On snubbing relays having one dependent front and back contact,

(1) Front heel contact should make contact centrally on front contact surface.

(2) With 0.013 in. spacer between stop pin, Ref.11, Fig.12, front contact, Ref.20, should be just open.

(3) With armature in energized position, the spring stop should clear spring by 1/64 in. min.

(4) Back heel contact, Ref.9, Fig.12, should make centrally on and evenly across back contact surface.

(5) With 0.022 in. spacer between stop pin, Ref.11, and pole face, back contact should be just open.

(6) With armature in deenergized position, opening between back contact spring and its stop should be 1/64 in. minimum.

(7) Lower, horizontal portion of locking spring, Ref.17, should clear heel contact arm by 0.010 in. min. with armature in deenergized position.

(8) Contact openings: 0.050 in. min.

(b) On snubbing relays having one independent back contact.

(1) Heel contact, Ref.9, Fig.12, should make centrally and evenly across back contact surface.

(2) With 0.018 in. spacer between stop pin, Ref.11, and pole face, back contact should be just open.

(3) Opening between contact spring, Ref.9, and its stop: 1/64 in. min. with armature in deenergized position.

(4) Lower horizontal portion of locking spring, Ref. 17, should clear heel contact arm by 0.010 in. min. with armature in deenergized position.

(5) Contact opening: 0.050 in. min.

4. Calibration

Drop-away calibration of snubbing relay should be adjusted by means of the compression spring to obtain the values specified as follows.

(a) Relay with one dependent front and back contact.

(Coil resistance 50 ohms).

(1) Charge Volts: 12 volts for shop; service voltage for field test.

(2) Drop-away: 5.5 volts max. - 5.0 volts min.

(3) Pick-Up: 7.5 volts max.

(b) Relay with one independent back contact

(Coil resistance 0.0625 ohm).

(1) Charge Amps: 8.0 amps. (0.5 volt) shop or field.

(2) Drop-away: 2.0 amps. max. - 1.5 amps. min.

(3) Pick-Up: 3.5 amps. max.

G. Slot Coils

1. (a) Holding coil (higher resistance): On inside core, nearest motor.

(b) Pick-up coil (lower resistance): On outside core, away from motor.

2. (a) Provide 1/16 in. space next to backstrap for coil lock spring. (Adjust by means of cork washers between end of coil and magnet bracket).

(b) Coils should be held tight by coil lock spring to prevent motion due to vibration.

3. Coil leads should be dressed neatly through guide clips.

H. Slot Backstrap

1. (a) Contacting surfaces of core and backstrap should be clean, bright, and free of plating and,

(b) May be wiped with clean cloth moistened with light oil to prevent rusting.

2. Should fit both cores so no light is visible through the joints.

3. Should be tightened down solid on both cores.

I. Slot Calibration

Tests should be made with the friction clutch on the motor shaft drawn up tight (the spring compressed solid) and with a circuit per Fig.1 of this specification.

1. Drop-Away (Without Load)

(a) Charge Voltage: Per Table I or Table II (Both coils in multiple).

(b) Disconnect pick-up coil.

(c) Gradually reduce voltage on holding coil until armature drops away full stroke.

(d) This value should be not less than "Min. Drop Away" specified in the tables.

2. Pick Up

(a) Following the drop-away calibration, open the circuit and again apply voltage to the two coils in multiple.

(b) Gradually increase the voltage until the armature moves to the pole faces.

(c) This value should be not greater than "Max. P.U." specified in the tables.

3. Drop-Away (With Load)

(a) Torque arm adjustment

With both slot coils energized at 12 volts, a balanced torque arm should be assembled horizontally on the pinion end of the motor shaft, as shown in Fig.2 of this specification, with a 1 pound 6 ounce weight suspended on the arm at a distance of 20 inches from the center of the motor shaft.

(b) Flexible coupling should be inspected to see that it operates freely.

(c) With the torque arm adjusted per (a) obtain the value for drop-

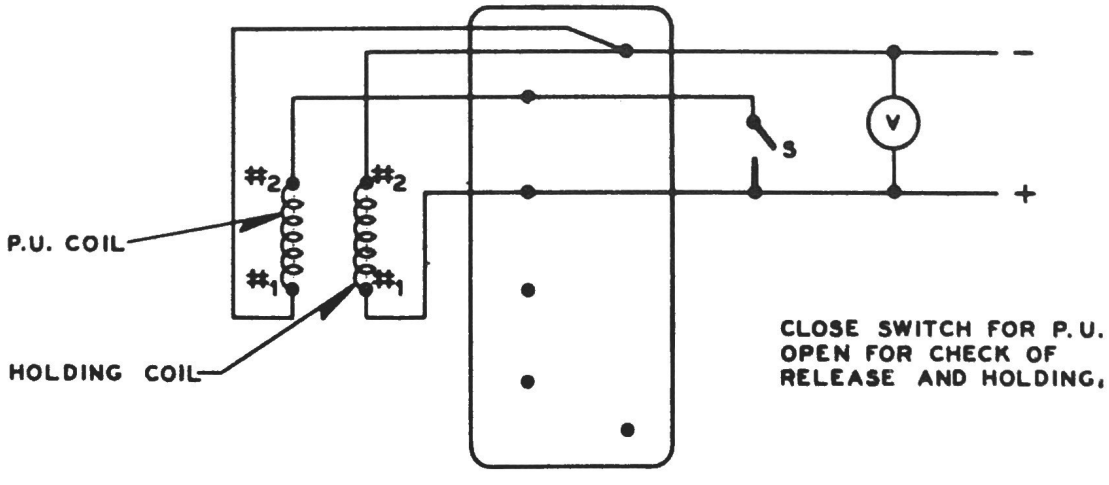


Fig. 1....Connections for Checking Calibration

away as described under paragraph I-1. This value should not exceed the value specified for "Max. Drop-Away".

J. Holding Force

1. With the slot coils in multiple, charge to 10 volts.
2. Disconnect the pick-up (low resistance) coil.
3. Hold the voltage on the holding coil at 10 volts.
4. Adjust the torque arm on the pinion so that the arm is horizontal with the 1 pound 6 ounce weight suspended from it.
5. Raise the weight 6 inches on the vertical rod or chain attached to the 20 inch torque arm and let the torque arm rise until the engaging ratchet gear tooth just touches the locking pawl but with no appreciable pressure.
6. Drop the weight from this position.
7. The slot armature stop bars should remain in contact with the pole faces.
8. Repeat the test on several different ratchet gear teeth.

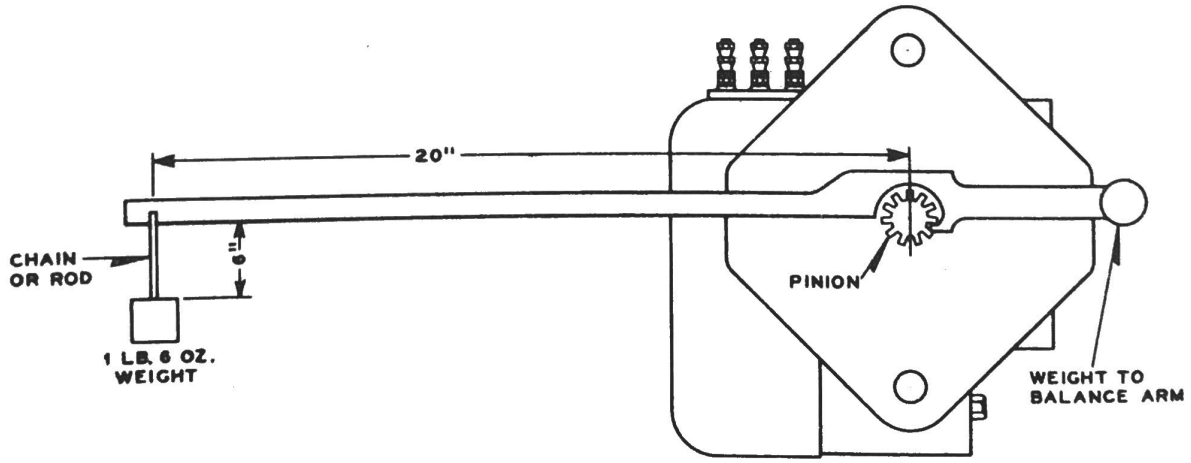


Fig. 2....Torque Arm for Check of Slot Holding Force and Maximum Release.

TABLE I

For Slots Equipped With Contacts

	Chg.Volts	Min.Drop-Away Volts (Without Load)	Max.Drop-Away Volts (With Load)	Max. P.U. Volts
100 Ohm P.U.500 Ohm Holding	12	3.5	6.0	9.0
100 Ohm P.U. 340 Ohm Holding	12	2.85	4.9	8.5
60 Ohm P.U. 340 Ohm Holding	12	2.85	4.9	7.2

TABLE II

For Slots Without Contacts and With Snubbing Relay

60 Ohm P.U. 340 Ohm Holding	12	2.85	4.9	8.5

III. Friction Clutch

Following the test for holding force:

A. The friction clutch on the pinion end of the motor shaft should be loosened until all parts are free.

B. Readjust to slip with a torque of not more than 3.0 ft.-lbs. or less than 2.5 ft.-lbs. applied to the pinion (1.8-1.5 lb.) on 20 inch arm.

IV. Lubrication (See Instruction Pamphlet)

V. Gate Shaft and Gears End Play

A. Gate Shaft: 0.007 in. min. to 0.031 in. max.

B. Gears: 0.005 in. min. to 0.035 in. max.

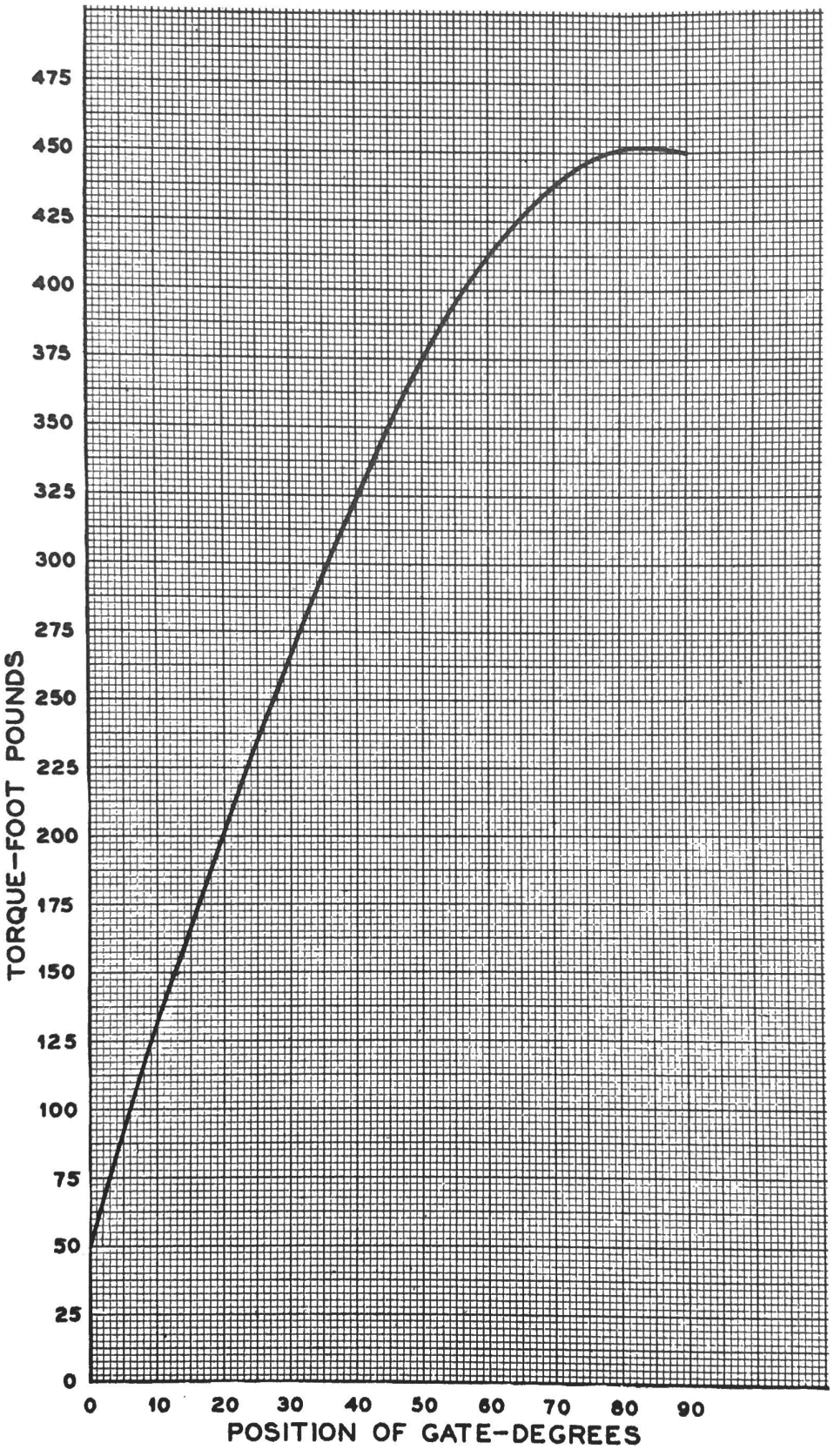
VI. Friction Torque

With motor and slot removed but with all gears, shafts, bearings, and the circuit controller assembled, and with gear segment at its uppermost position, the weight of the gear segment should start and drive the gears backward until the gear segment hits the lower stop.

VII. Operating Tests on Mechanism

A. Adjustable Spring Gate Stops (See Instruction Pamphlet)

B. Circuit Controller (See Instruction Pamphlet)


TORQUE-FOOT POUNDS
475
450
425
400
375
350
325
300
275
250
225
200
175
150
125
100
75
50
25
0
0
10
20
30
40
50
60
70
80
90
POSITION OF GATE-DEGREES

C. Wiring

Wiring should be as shown on the mechanism circuit diagram tag inside the mechanism cover.

D. Torque Arms

1. Due to the wide variation in lengths of gate arms and the torque adjustments used it is recommended that shop tests of all mechanisms be made with an actual gate assembly or, if clearance is restricted in the repair shop, with a torque arm testing assembly that is adjusted to impose on the mechanism the same torque as that of a counter-weighted gate arm.
2. For purposes of standardization and of convenience it is recommended that the torque of the test gate arm or torque arm testing assembly be the same for all mechanisms tested and that the torque throughout the stroke be approximately as indicated by the torque curve shown on page 10 which provides for 450 ft.-lb. torque at the 90 degree gate position and 50 ft.-lbs. at the 0 degree gate position. Fig. 3 illustrates a torque arm testing assembly that provides this torque adjustment.

E. Resistance Unit

(See Instruction Pamphlet)

F. Snubbing Relay for Gravity-Down Mechanisms

Snubbing Relay should be energized and operating properly to open its back contact while the mechanism is clearing and should be deenergized and have its back contact properly closed when the mechanism is latched in the clear position.

G. Reverse Control Relay for Power-Down Mechanisms With Centrifugal Governor (Coil resistance - 112 ohms)

1. Screws holding the relay on its supporting bracket should be tight so the relay is held securely in place.
2. Relay should be energized and operating properly to open its back contacts and close its front contacts when the control is such as to apply power to drive the mechanism from the clear position toward the horizontal gate position.
3. Relay should be deenergized when the 90^{o}-45^{o} motor control cam drives the 90^{o}-45^{o} motor control contact open.

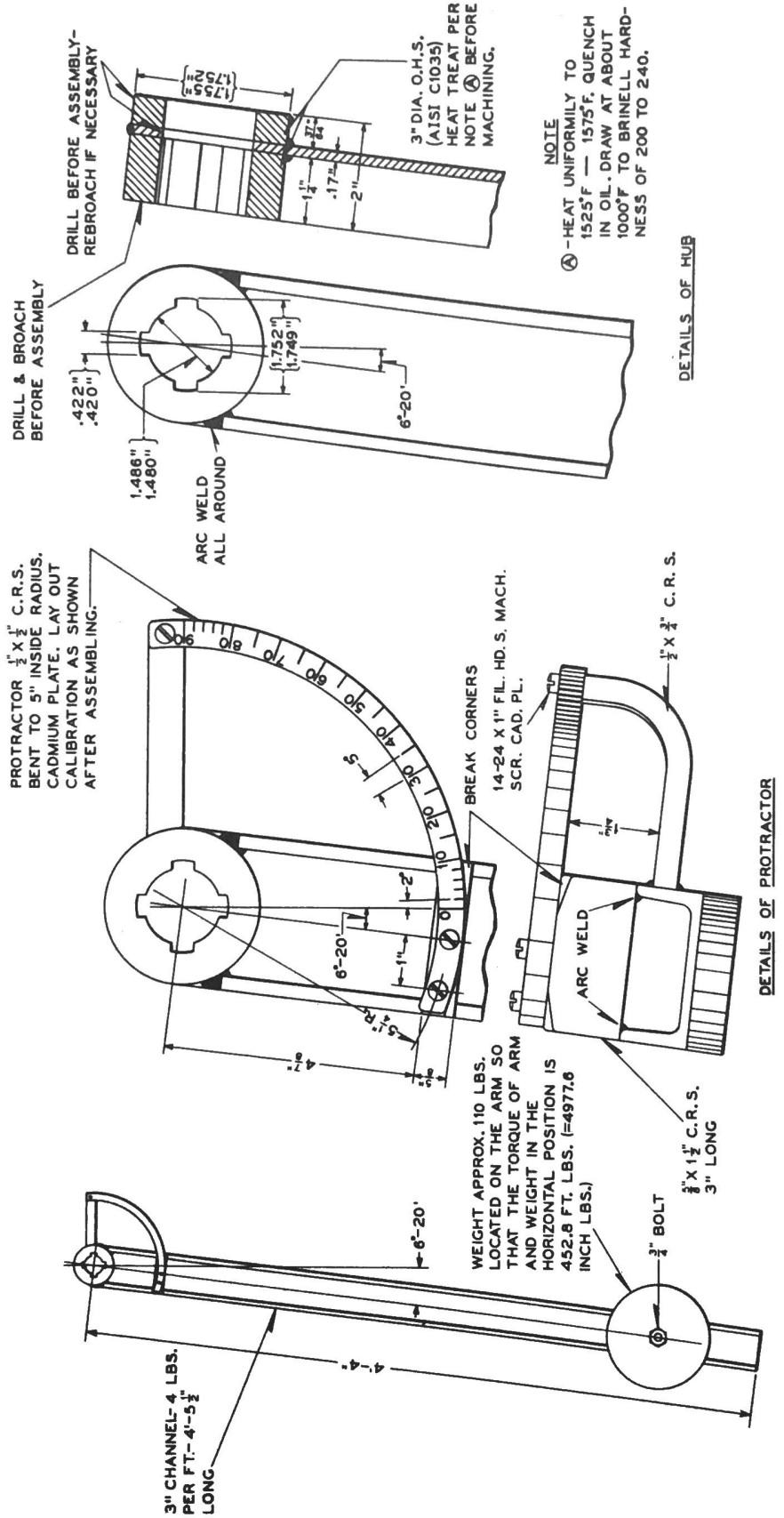

DRILL BEFORE ASSEMBLY-REBROACH IF NECESSARY
3" DIA. O.H.S. (AISI C1035) HEAT TREAT PER NOTE Ⓐ BEFORE MACHINING.
NOTE
Ⓐ-HEAT UNIFORMILY TO 1525°F — 1575°F. QUENCH IN OIL. DRAW AT ABOUT 1000°F TO BRINELL HARDNESS OF 200 TO 240.
DRILL & BROACH BEFORE ASSEMBLY
.422" .420"
1.486" 1.480"
ARC WELD ALL AROUND
6'-20'
DETAILS OF HUB
PROTRACTOR ½"X 1" C.R.S. BENT TO 5" INSIDE RADIUS. CADMIUM PLATE. LAY OUT CALIBRATION AS SHOWN AFTER ASSEMBLING.
BREAK CORNERS
14-24 X 1" FIL. HD. S. MACH. SCR. CAD. PL.
½"X ¼" C. R. S.
ARC WELD
DETAILS OF PROTRACTOR
WEIGHT APPROX. 110 LBS. LOCATED ON THE ARM SO THAT THE TORQUE OF ARM AND WEIGHT IN THE HORIZONTAL POSITION IS 452.8 FT. LBS. (=4977.6 INCH LBS.)
¾" BOLT
¾"X 1½" C.R.S. 3" LONG
3" CHANNEL- 4 LBS. PER FT.- 4'-5½" LONG

Fig. 3....Torque Test Arm for 50 Ft.-Lbs. at Zero Position, and 450 Ft.-Lbs. at 90° Position.

4. Shop repairs and calibration - Per Service Spec. 2597-G.
5. Field Calibration.
   (a) Drop-Away: 1.6 volts min.
   (b) Pick-Up: 9.8 volts max.

H. Motor Control and Snubbing Relay for Power-Down Mechanisms With Friction Clutch Only.

1. Relay should be energized and operating properly to open its back contacts and close its front contacts when the control is such as to apply power to drive the mechanism and gate arm from the horizontal toward the clear gate position.
2. Relay should be deenergized when the 0^{o}-89^{o} motor control cam operates to open the 0^{o}-89^{o} control contact.
3. Shop Repairs and calibration: Per Service Specification 2666-P.
4. Field Calibration.
   (a) Drop-Away: 2.41 volts min.
   (b) Pick-Up: 9.02 volts max.

VIII. Calibration of Mechanism

A. Power Supply Recommended - 8 cells lead storage battery.

B. Resistance of Leads From Battery to Mechanism - 0.06 ohm total.

C. With gate arm or torque arm testing assembly, Fig. 3 of this specification, at clear position -

1. Pull armature bar back to compress coil springs solid.
2. Engagement of locking pawl with ratchet gear tooth should be 0.020 in. min.

D. Slot Calibration - Check per Table III

1. Values apply to slots on either gravity-down or power-down mechanisms.

E. Mechanism Calibration - Tables IV and V.

1. Use Table IV for gravity-down and for power-down mechanisms.
2. Use Table V in addition to IV for power-down mechanisms with centrifugal governor.
3. For Table IV use 450 ft.-lb. data with special torque arm per Section VII-D2, if practicable, in lieu of gate arm, otherwise use gate arm complete for data at 350 or 200 ft.-lbs.

4. Use Table VI in addition to IV for power-down mechanisms with friction clutch only.

TABLE III

Slot Calibration

Gravity-Down and Power-Down Type Mechanisms

Slot holding winding	500 ohms 100 ohms	340 ohms 100 ohms	340 ohms 60 ohms
Min. drop-away volts per Section II after gate reaches clear position on full battery voltage (New)	3.5 V.	2.85 V.	2.85 V.
Max. drop-away volts per Section II after gate reaches clear position on full battery voltage (New)	6.0 V.	4.9 V.	4.9 V.
Min. no-load drop-away per Section II (New)	3.5 V.	2.85 V.	2.85 V.

TABLE IV

Mechanism Calibration

Gravity-Down and Power-Down Type Mechanisms

Gate Torque at 0°	50 ft.-lb.	50 ft.-lb.	50 ft.-lb.
Gate Torque at 90°	450 ft.-lb.	350 ft.-lb.	200 ft.-lb.
Min. Volts to Clear to 90°	9.0 V.	7.0 V.	6.0 V.
Min. Volts to Clear and latch at 90°	9.0 V.	9.0 V.	9.0 V.
Max. Current While Clearing	11.5 A.	9.0 A.	7.0 A.
Max. time clearing from 0°	From 13.5 Sec. at 14 V. to 10.5 Sec. at 17 V.	13.0 Sec. at 12 V., 8.0 Sec. at 16 V.	14 Sec. at 10 V., 8.5 Sec. at 14 V.
Buffing time, clear position to 0°	10 - 15 Sec.	10 - 15 Sec.	10 - 15 Sec.

TABLE V.

For Mechanisms (with centrifugal governor) Motor Driven Down (90^{o}-45^{o})

Max. current 90^{o}-45^{o}	5.0 amp. at 12 V.
	6.0 amp. at 14 V.
	8.0 amp. at 17 V.

TABLE VI

For Mechanisms (with friction clutch only) Motor Driven Down (90^{o}-45^{o})

	Max. Current 90^{o}-45^{o}							
Gate Torque at 0^{o} Gate Torque at 90^{o}	50 Ft.-lb. 450 Ft.-lb.				50 Ft.-lb. 200 Ft.-lb.			
Snubbing Resistance - Ohms	1.0	0.8	0.6	0.4	1.0	0.8	0.6	0.4
Volts 11					4.8	6.5	8.1	10.9
12	2.4	4.6	6.8	10.2	5.5	7.4	9.1	12.0
13	3.3	5.6	7.8	11.3	6.3	8.2	10.1	13.2
14	4.1	6.5	8.8	12.4	7.1	9.1	11.0	14.3
15	4.9	7.4	9.8	13.5	7.8	9.9	12.0	15.4
16	5.8	8.2	10.8	14.6	8.6	10.8	12.9	16.5
17	6.6	9.0	11.7	15.8				

IX. Field (Service) Data:

Field values are shown on calibration tag in slot cover.

1. Slots should meet Table IV values except:

   (a) Min. drop-away with or without load = 67% of Table IV.

   (b) Min. armature air gap = 0.010 in.

2. All other values in Tables III, IV, V, and VI apply to field as well as shop.

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